Attorney Docket No. 02814.0051
Customer Number 22,852

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	
Christopher Gordon Gervase TURNER et al.	)	Group Art Unit: 2821
	)	
Serial No.: 09/881,741	)	Examiner: Not Yet Assigned
	)	
Filed: June 18, 2001	)	
	)	
For: **BROAD BANDWIDTH, HIGH IMPEDANCE TRANSPONDER FOR ELECTRONIC IDENTIFICATION SYSTEM**	)	

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

CLAIM FOR PRIORITY

Under the provisions of 35 U.S.C. § 119, Applicants hereby claim the benefit of the filing date of South African Patent Application No. 2000/3072, filed June 19, 2000, for the above-identified U.S. patent application.

In support of this claim for priority, enclosed is one certified copy of the priority application.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.

Dated: September 26, 2001

By: _____
Ernest F. Chapman
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ASG/FPD/sci
Enclosures

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Sertifikaat

REPUBLIEK VAN SUID-AFRIKA

PATENTKANTOOR

DEPARTEMENT VAN HANDEL EN NYWERHEID

Certificate

REPUBLIC OF SOUTH AFRICA

PATENT OFFICE

DEPARTMENT OF TRADE AND INDUSTRY

Hiermee word gesertifiseer dat
This is to certify that

CERTIFIED COPY OF
PRIORITY DOCUMENT

1) South African Patent Application No. **2000/3072** accompanied by a Provisional Specification was filed at the South African Patent Office on the **19 June 2000**, in the name of **Supersensor (Proprietary) Limted** in respect of an invention entitled: **"Broad bandwidth, high impedance transponder for electronic identification system"** .

2) The photocopy attached hereto is a true copy of the provisional specification and drawings filed with South African Patent Application No. **2000/3072.**

n te PRETORIA in die Republiek van Suid-Afrika, hierdie 21 dag van June 2001
at in the Republic of South Africa, this day of

Registrateur van Patente
Registrar of Patents

Form P.2

REPUBLIC OF SOUTH AFRICA

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REGISTER OF PATENTS

P/00/78422

OFFICIAL APPLICATION NO.	LODGING DATE : PROVISIONAL	ACCEPTANCE DATE
21 01 20003072	22 19-06-2000	43
INTERNATIONAL CLASSIFICATION	**LODGING DATE : COMPLETE**	**GRANTED DATE**
51	23	47

FULL NAME(S) OF APPLICANT(S)/PATENTEE(S)

71 SUPERSENSOR (PROPRIETARY) LIMITED

APPLICANTS SUBSTITUTED:	DATE REGISTERED
71	

ASSIGNEE(S)	DATE REGISTERED
71	

FULL NAME(S) OF INVENTOR(S)

72
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2. PROCTOR, David Edwin
3. FOURIE, Andries Petrus Cronje

PRIORITY CLAIMED	COUNTRY	NUMBER	DATE
N.B. Use International abbreviation for country. (See Schedule 4)	33	31	32

TITLE OF INVENTION

54 BROAD BANDWIDTH, HIGH IMPEDANCE TRANSPONDER FOR ELECTRONIC IDENTIFICATION SYSTEM

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DMK

P/00/78422

PATENT OF ADDITION NO.	DATE OF ANY CHANGE
61	
FRESH APPLICATION BASED ON	**DATE OF ANY CHANGE**

D.M. KISCH INC. , Johannesburg

Form P.1

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

APPLICATION FOR A PATENT AND ACKNOWLEDGEMENT OF RECEIPT
(Section 30 (1) - Regulation 22)
The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate.

PATENT APPLICATION NO.			AGENT'S REFERENCE
21	01	20003072	P/00/78422

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REGISTRAR OF PATENTS, DESIGNS, TRADE MARKS AND COPYRIGHT
2000 -06- 19
REGISTRATEUR VAN OCTROOIE, MODELLE, HANDELSMERKE EN OUTEURSREG

TITLE OF INVENTION		
54	BROAD BANDWIDTH, HIGH IMPEDANCE TRANSPONDER FOR ELECTRONIC IDENTIFICATION SYSTEM	
	THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2. The earliest priority claimed is	
	THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO.	21 01
	THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND BASED ON APPLICATION NO.	21 01

THIS APPLICATION IS ACCOMPANIED BY :

X	1	A single copy of a provisional ~~xxxxxxxxxxxxxxxxxxxxxxxxx~~ specification of 10 pages.
X	2	Drawings of 6 sheets.
	3	Publication particulars and abstract (Form P.8. in duplicate).
	4	A copy of Figure of the drawings for the abstract.
	5	An assignment of invention.
	6	Certified priority document(s) (State number).
	7	Translation of priority document(s).
	8	An assignment of priority rights.
	9	A copy of Form P.2 and specification of S.A. Patent Application No. 21 01
	10	A declaration and power of attorney on Form P.3.
	11	Request for ante-dating on Form P.4.
	12	Request for classification on Form P.9.
	13	

DATED THIS 19 th DAY OF June 2000

Patent Attorney for the Applicant(s)

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RECEIVED REGISTRAR OF PATENTS, DESIGNS, TRADE MARKS AND COPYRIGHT
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2000 -06- 19
REGISTRAR OF PATENTS, MODELLE, HANDELSMERKE EN OUTEURSREG
REGISTRAR OF PATENTS

D.M. KISCH INC. , Johannesburg

Patent Attorneys & Trademark Agents
Attorneys & Notaries

Form P.6

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978.

PROVISIONAL SPECIFICATION

(Section 30 (1) - Regulation 27)

PATENT APPLICATION NO.			LODGING DATE.		AGENT'S REFERENCE
21	01	20003072	22	19-06-2000	P/00/78422

FULL NAME(S) OF APPLICANT(S)	
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FULL NAME(S) OF INVENTOR(S)	
72	1. TURNER, Christopher Gordon Gervase 2. PROCTOR, David Edwin 3. FOURIE, Andries Petrus Cronje

TITLE OF INVENTION	
54	BROAD BANDWIDTH, HIGH IMPEDANCE TRANSPONDER FOR ELECTRONIC IDENTIFICATION SYSTEM

INTRODUCTION AND BACKGROUND

THIS invention relates to electronic radio frequency (RF) identification systems comprising a reader and a plurality of transponders. The invention more particularly relates to transponders forming part of such a system.

Known electronic systems of the aforementioned kind comprise an interrogator or reader comprising a transmitter for transmitting an energizing signal to the transponders and a receiver for receiving a response signal from the transponders. A microprocessor in the reader identifies a particular transponder by a data stream in the response signal. Each transponder comprises an antenna connected to an integrated circuit hosting electronic circuitry for receiving and collecting power from the interrogation signal to present a high enough voltage on a voltage storage capacitor, to power the circuitry which in turn generate the aforementioned data stream. The data stream is used by the transponder to modulate the energizing signal and to reflect back to the reader a portion of the energy in the energizing signal, by what is known as backscatter modulation. In the applicant's US Patent 6,054,925, there is disclosed a transponder with a high input impedance which the applicant believes will improve on the limited effective distance of prior art systems. The higher the input impedance of the integrated circuit and the antenna feedpoint impedance, the higher the voltage recovered from the energizing signal and stored on the capacitor.

It is also known that the higher the aforementioned impedances, the higher the quality factor (Q) of the circuit and consequently the narrower the bandwidth of the transponder becomes. Known transponders with relatively high impedances have a bandwidth of in the order of 1% -2%. The applicant has identified a need for a practical system to cover the range 860 MHz to 930 MHz and which hence requires a bandwidth of about 7% to 10%.

OBJECT OF THE INVENTION

Accordingly it is an object of the present invention to provide an electronic identification system and a transponder with which the applicant believes the aforementioned disadvantages may at least be alleviated.

SUMMARY OF THE INVENTION

According to the invention there is provided a transponder for an electronic identification system comprising:

- an antenna having a feedpoint at a position thereon where there is a current minimum;
- an electronic circuit having an input, the input being connected to the feedpoint; and
- the antenna, when driven at the feedpoint having at least two resonant modes, to provide a wider bandwidth for the transponder.

The circuit may have an input impedance comprising a real component and a capacitive reactive component.

The antenna may have an antenna impedance at the feedpoint and the antenna impedance may be matched with the input impedance, an inductive element connected between the antenna and the circuit being operative to resonate with the capacitive component of the input impedance.

The real part of the input impedance may be at least 1000 ohms and is preferably larger than 1500 ohms.

The two resonant modes of the antenna may comprise first and second resonant frequencies respectively. The first resonant frequency may be between 850 MHz and 900 MHz and the second resonant frequency may be between 900 MHz and 1 GHz.

The dual resonant mode antenna may in a first embodiment comprise a combination of a patch antenna and a transmission line both connected to the feedpoint.

In a second embodiment, the antenna may comprise a shorted ring patch antenna and a transmission line both connected to the feedpoint.

In a third embodiment the antenna may comprise a loop and an appendage to the loop. The feedpoint may be provided on the loop, so that a distance in a clockwise direction along the loop from the feedpoint to the appendage is not equal to a distance in an anti-clockwise direction along the loop to the appendage.

At least part of the loop and/or the appendage may have a zigzag configuration.

The invention also includes within its scope an antenna as herein defined and described.

Yet further included within the scope of the present invention is an electronic identification system comprising a reader or interrogator and at least one transponder as herein defined and/or described.

BRIEF DESCRIPTION OF THE ACCOMPANYING DIAGRAMS

The invention will now further be described, by way of example only, with reference to the accompanying diagrams wherein:

figure 1 is a block diagram of an electronic radio frequency (RF) identification system;

figure 2 is a very basic block diagram of a transponder according to the invention;

figure 3 is a basic diagram of a response curve of a transponder according to the invention;

figure 4 is a diagram of a first embodiment of a dual resonant mode antenna forming part of the transponder;

figure 5 is a diagram of the frequency response of the antenna in figure 4;

figure 6 is a diagram of a second embodiment of a dual resonant mode antenna forming part of the transponder;

figure 7 is a diagram of the frequency response of the antenna in figure 6;

figure 8 is a diagram of a third embodiment of a dual resonant mode antenna forming part of the transponder; and

figure 9 is a diagram of the frequency response of the antenna in figure 8; and

figure 10 is a diagram of the frequency response of a transponder comprising the antenna in figure 4 and an LC tuned circuit between the antenna and transponder circuitry.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

An electronic radio frequency (RF) identification system according to the invention is generally designated by the reference numeral 10 in figure 1.

The system comprises a reader 12 and a transponder population 14 comprising transponders 14.1 to 14.n. In use, the transponders may be mounted on or otherwise associated with items or articles (not shown) to be counted or identified. The transponders may be active transponders comprising their own local power supplies or they may be passive transponders in that they derive power to operate from an energizing signal 16 transmitted by the reader. The transponders are similar in configuration and therefore transponder 14.1 only will be described further. Transponder 14.1 comprises an antenna 18, an integrated circuit 19 connected to the antenna and comprising a modulator 20, a controller 22 and a memory arrangement 24.

In use, the reader transmits an energizing signal 16 towards the transponder population 14. The transponders derive their power from this signal as is known in the art and transmit respective response signals 26.1 to 26.n by backscatter modulating the signal in known manner with a frame of data prestored in memory arrangement 24. The reader sequentially locks onto one of the response signals and reads the data as will hereinafter be described. Once the population has been read, the aforementioned items are identified and/or counted.

A block diagram of the transponder 14.1 is shown in figure 2. The transponder 14.1 comprises an antenna 18 having a feedpoint 30 in a

region thereof where there is a current minimum, so that it has a relatively higher feedpoint impedance Z_A. The antenna feedpoint 30 is connected to input 32 of the aforementioned integrated circuit (IC) 19, having an input impedance Z_c. A typical input impedance of the IC 19 comprises a 1.95 pF capacitor in parallel with a resistance of 1600 .

The antenna, when driven at the feedpoint 30, has at least first and second relatively high impedance resonant modes comprising first and second resonant frequencies f_L and f_H respectively, both shown in figure 3. The antenna impedance is matched with the input impedance by an LC circuit 34 and with the closely spaced resonant frequencies f_L and f_H at 870 MHz and 930 MHz respectively, provide high impedance and wideband characteristics of the transponder.

A first embodiment 118 of a dual resonant mode antenna for use with a transponder 14.1 is shown in figure 4. The antenna 118 is a patch antenna comprising a ground plane 120, an insulating layer 122 of about 10mm in thickness and a grid or conductive layer 124 connected to the ground plane 12 as shown. The antenna 118 is driven at feedpoint 130 located in a region where there is a current minimum. A transmission line 132 is integrated with the patch antenna and is also connected to the feedpoint 130 and layer 124. The antenna 118 has a frequency response

as shown in figure 5, clearly displaying its dual resonant modes and consequent wideband characteristics.

A second embodiment 218 of a dual resonant mode antenna for use with a transponder 14.1 is shown in figure 6. The antenna 218 is a shorted ring patch antenna comprising a ground plane 220, an insulating layer 222 of about 10mm thickness and a top conductive grid or layer 224 connected to the ground plane 220 as shown. The antenna 218 is driven at feedpoint 230 located in a region where there is a current minimum. A transmission line 232 is integrated with the patch antenna and is also connected to the feedpoint 230. The antenna 218 has a frequency response as shown in figure 7, clearly displaying its dual resonant modes and consequent wideband characteristics.

A third embodiment 318 of a dual resonant mode antenna for use with a transponder 14.1 is shown in figure 8. The antenna 318 is a zigzag hybrid loop. Three typical feedpoints 330.1, 330.2 and 330.3 are shown. When driven at feedpoint 330.1, the antenna exhibits single resonant mode operation as shown at 320 in figure 9. However, when driven at feedpoint 330.2 or feedpoint 330.3, it exhibits dual resonant mode operation. The dual mode operation is caused by the different path lengths (clockwise and anti-clockwise) around the loop 322. At feedpoint 330.2 the resonant frequencies are closer together, as shown at 324 in figure 9 and at

feedpoint 330.3 the resonant frequencies are further apart, as shown at 326 in figure 9.

The LC network 34 between the antenna 18 and IC 19 cannot be used to add a further resonant mode, but can advantageously be used to adjust or emphasize one existing mode relative to another. The diagram in figure 10 illustrates the effect on the response of the patch antenna in figure 4, if an inductor (L) in the LC network is chosen such that the LC network 34 resonates at three different frequencies (860 MHz; 900 MHz and 940 MHz) in the region of f_L and f_H. The resulting responses are shown at 400, 402 and 404 in figure 10. It is shown that the voltage peak associated with each mode can be adjusted using an appropriate tuned frequency for the LC network. The same method may be utilized to obtain a flatter response.

It will be appreciated that there are many variations in detail on the transponder, antenna, electronic identification system and method according to the invention without departing from the scope and spirit of this disclosure.

Dated this 19 day of June 2000

Patent Attorney ~~/Agent~~ for the Applicant

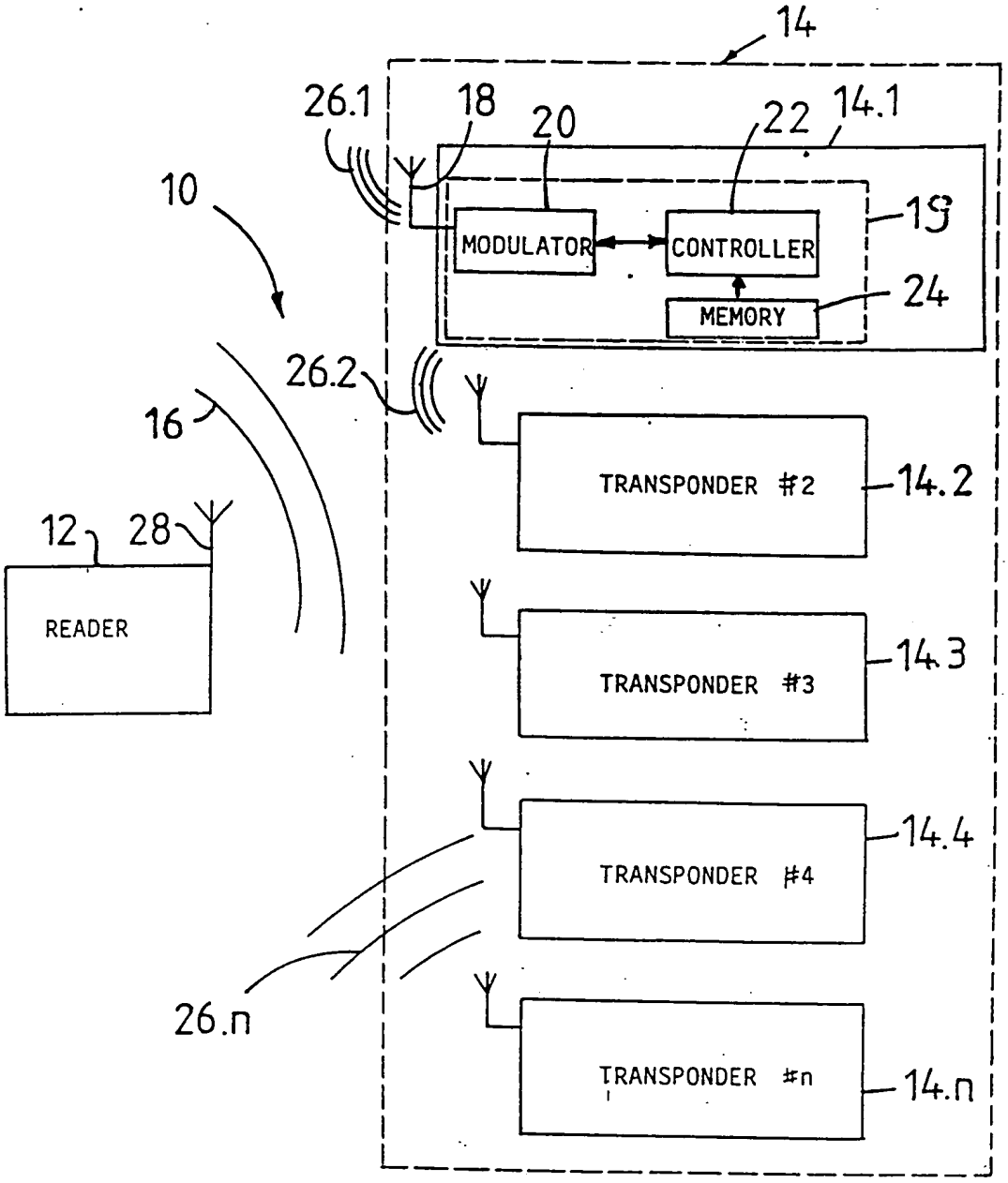

FIGURE 1

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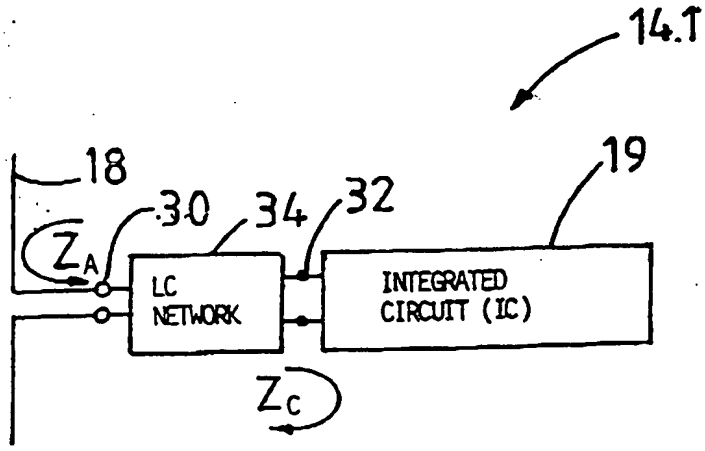

FIGURE 2

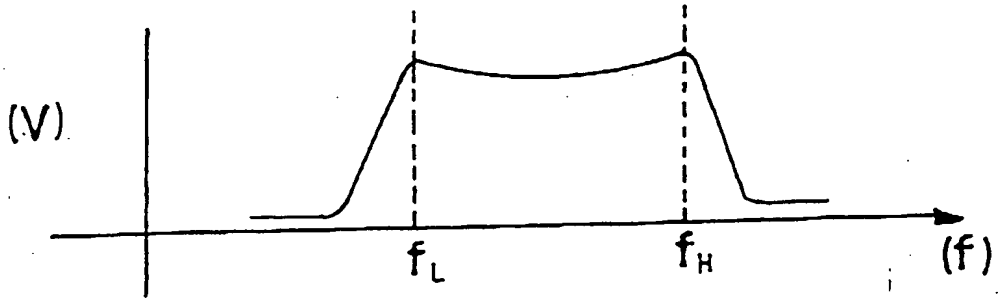

FIGURE 3

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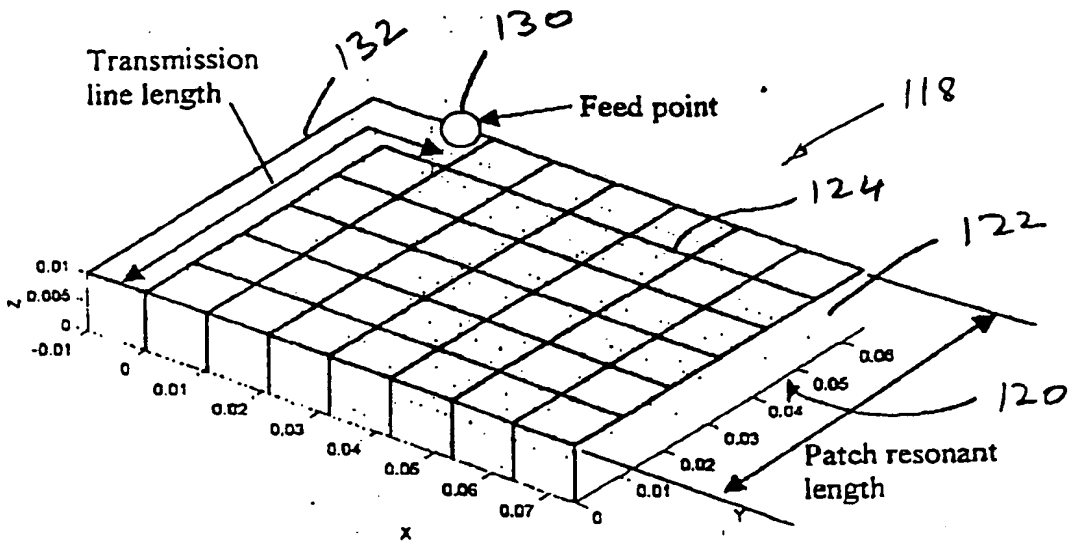

Figure 4

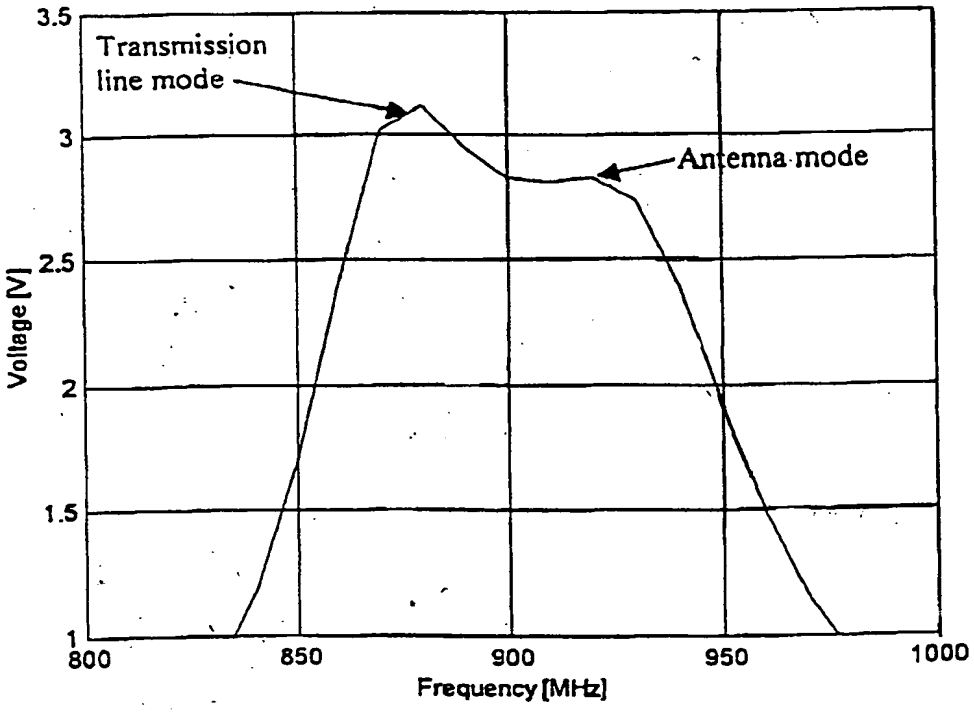

Figure 5

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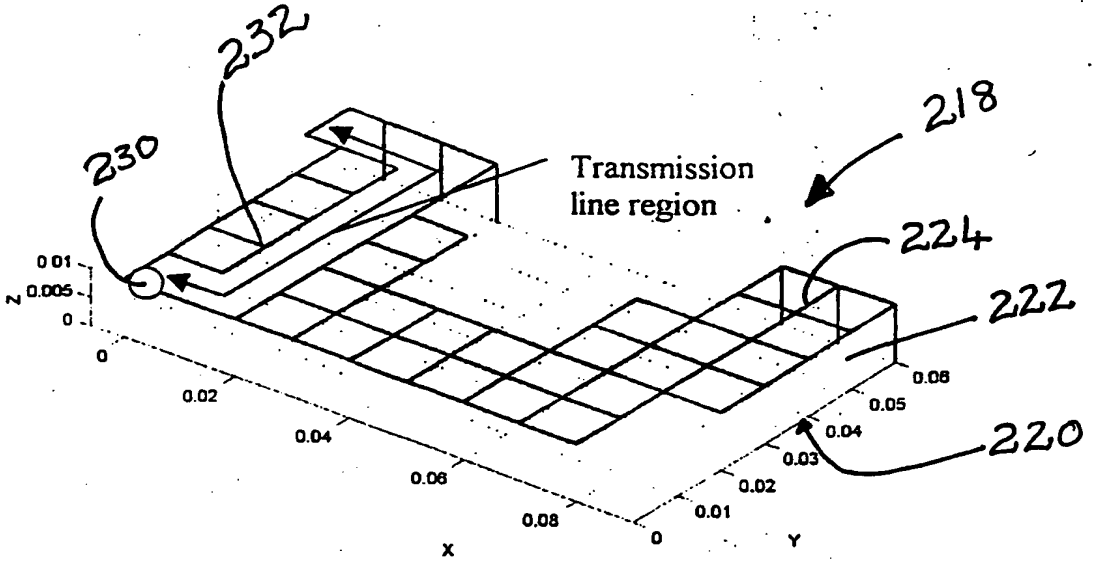

Figure 6

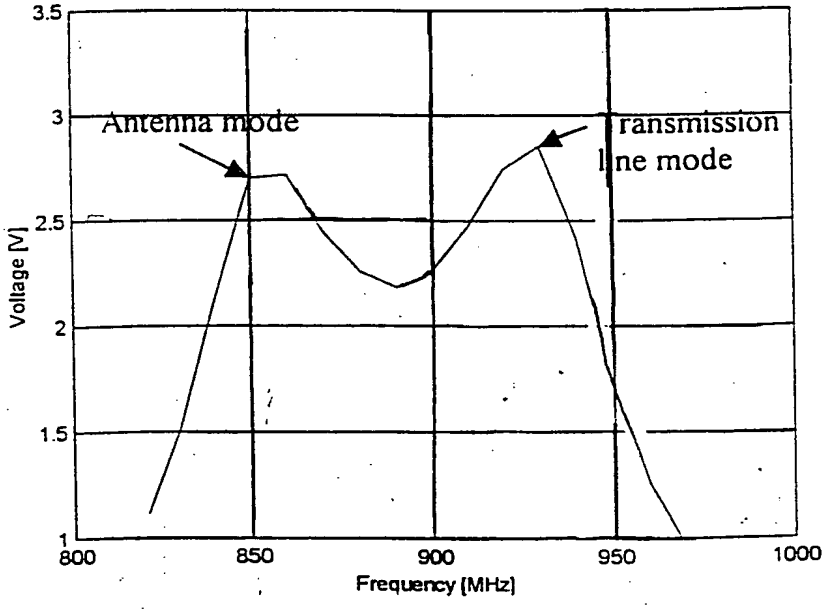

Figure 7

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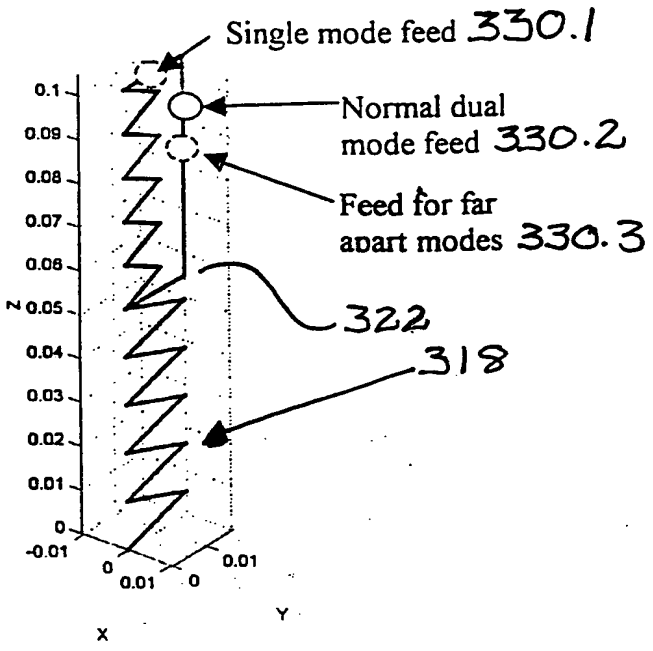

Figure 8

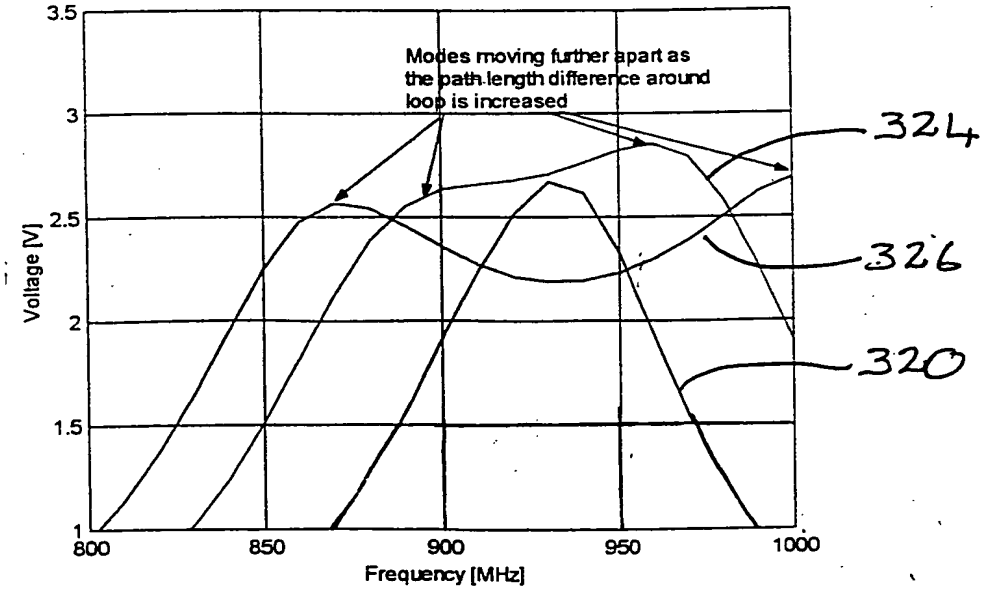

Figure 9

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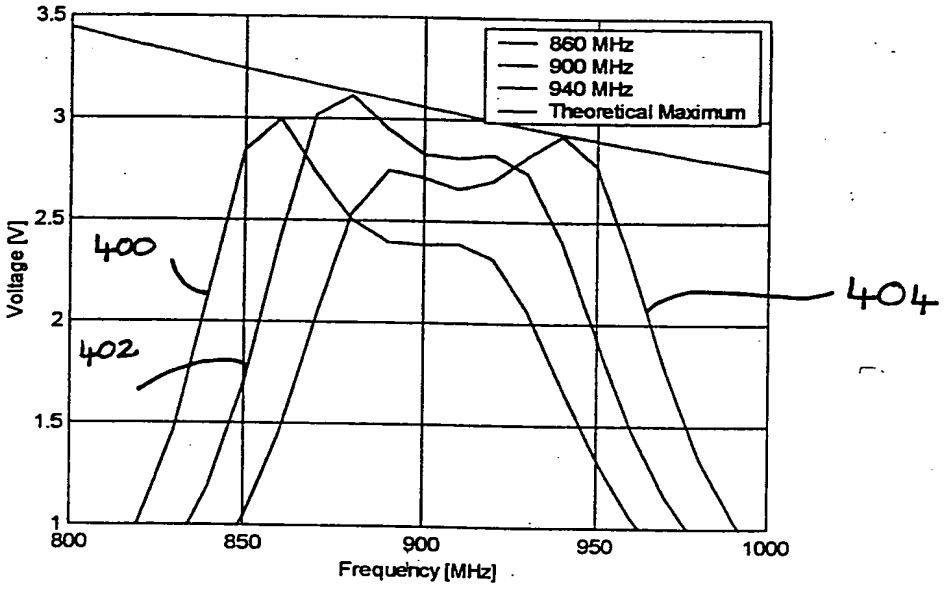

Figure 10

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